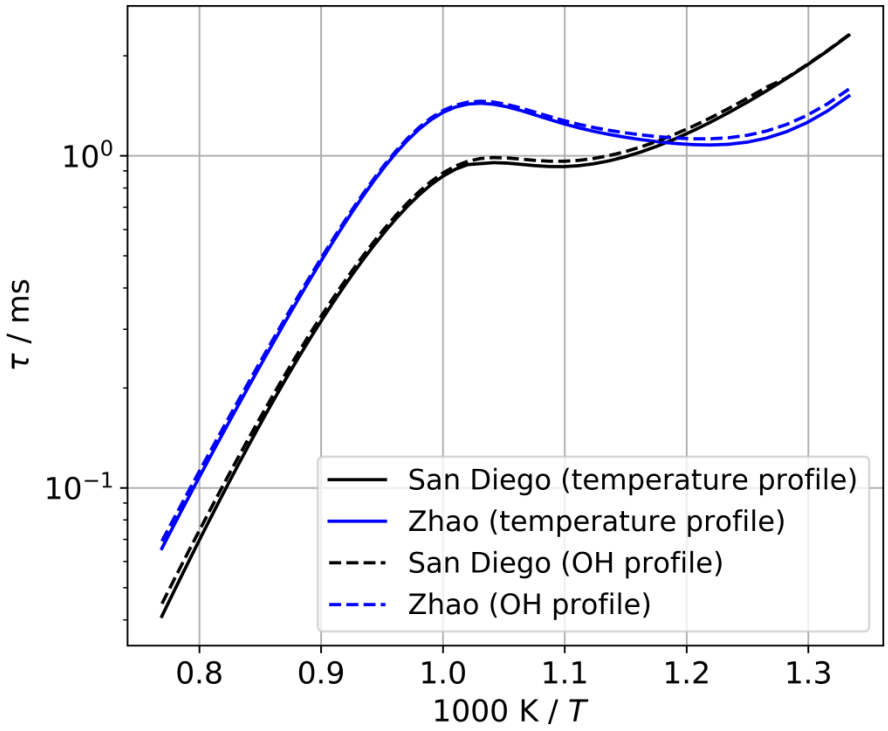
Supplementary Material

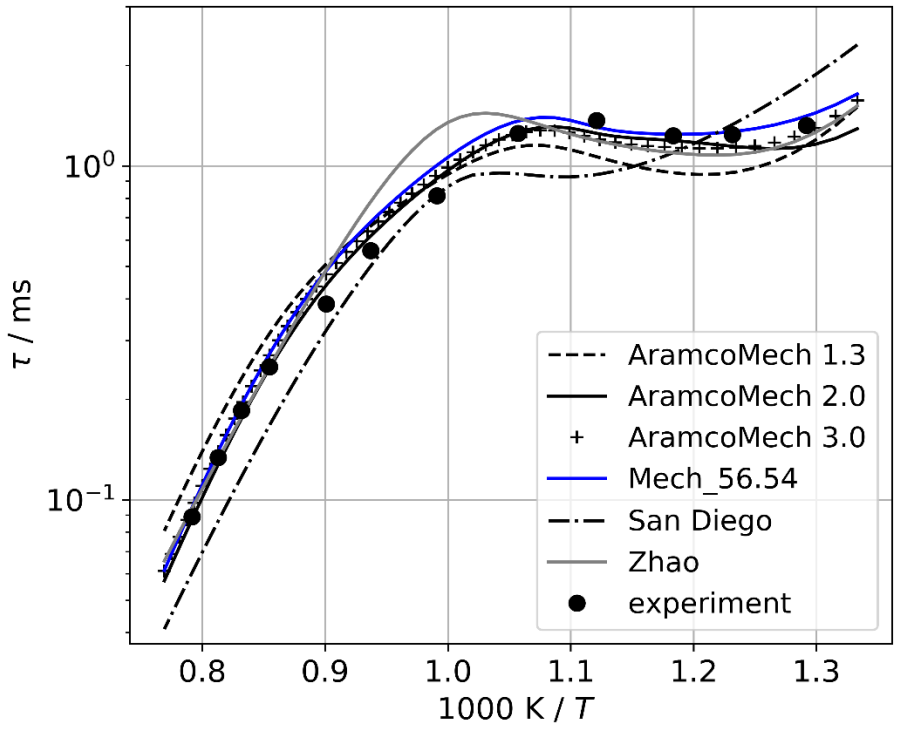
Exact measurement conditions and corresponding ignition delay times obtained in the high-pressure shock tube study

Mixture M1: 6.431% DME, 19.378% O_2, 74.191% N_2 (ϕ=0.996)			
T (K)	P (bar)	τ (ms)	τ_{1st} (ms)
686.9	33.31	3.1328	
723.3	37.89	1.1424	
736.9	34.05	0.8972	0.8124
796.7	34.37	0.3584	0.2046
796.7	34.89	0.3584	0.2045
830.1	33.58	0.2949	0.0883
894.8	35.03	0.2939	0.0553
942.5	34.57	0.3420	0.0851
993.3	34.90	0.3549	
1002.4	35.19	0.3105	
1057.2	35.67	0.2734	
Mixture M2: 6.408% DME, 19.186% O_2, 74.406% CO_2 (ϕ=1.002)			
T (K)	P (bar)	τ (ms)	τ_{1st} (ms)
720.6	35.74	1.2709	
744.7	34.31	0.8036	0.6016
801.1	35.11	0.4612	0.1795
863.8	32.18	0.4315	
885.3	34.65	0.4183	0.0642
941.4	35.06	0.4101	0.0893
995.9	35.24	0.3370	
1054.1	35.90	0.2312	
1104.7	35.47	0.1510	
Mixture M3: 3.914% DME, 11.453% O_2, 84.633% N_2 (ϕ=1.025)			
T (K)	P (bar)	τ (ms)	τ_{1st} (ms)
845.4	39.92	0.7427	0.1321
949.3	38.97	0.7998	
1120.4	35.90	0.3409	
1211.2	35.43	0.1476	
1259.0	40.28	0.0853	
Mixture M4: 3.929% DME, 11.500% O_2, 44.599% N_2, 39.972% CO_2 (ϕ=1.025)			
T (K)	P (bar)	τ (ms)	τ_{1st} (ms)
774.2	38.15	1.3215	
812.0	36.66	1.2397	0.1829
845.0	34.65	1.2318	0.1069
892.5	34.14	1.3682	0.1959
945.5	34.31	1.2508	
1009.1	35.50	0.8140	
1066.9	35.78	0.5579	
1109.6	35.49	0.3857	
1170.3	36.20	0.2502	
1201.7	34.68	0.1851	

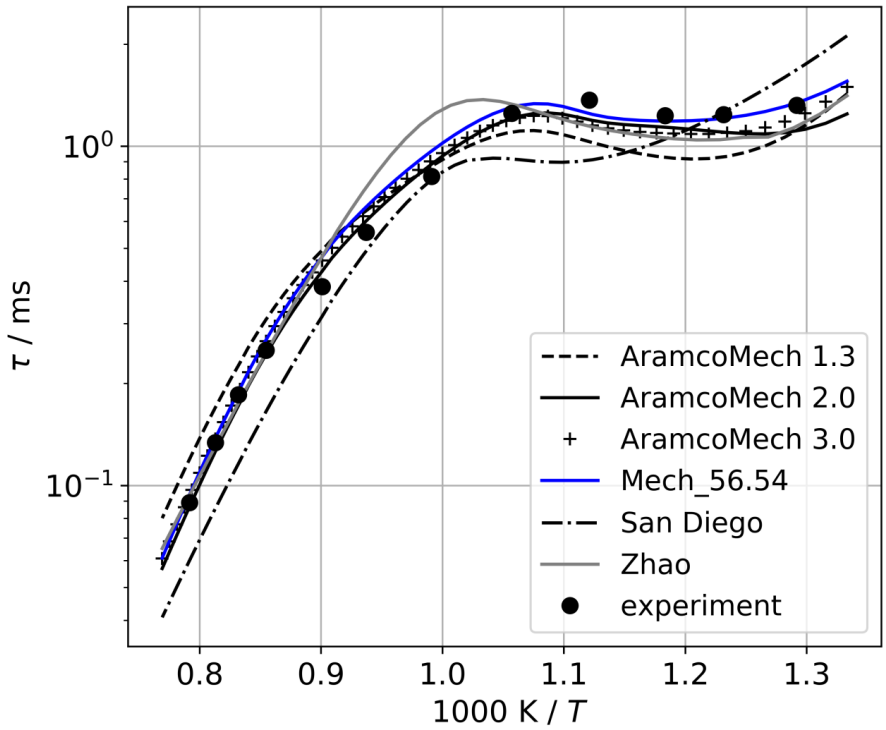
1230.4	37.02	0.1338	
1263.3	33.10	0.0889	
Mixture M4.1: 3.923% DME, 11.488% O_2, 44.552% N_2, 40.037% CO_2 (ϕ=1.024)			
T (K)	P (bar)	τ (ms)	τ_{1st} (ms)
744.1	49.18	1.1836	0.6635
795.6	50.16	0.8194	0.2230
839.1	49.59	0.7469	0.1128
879.0	47.83	0.7451	0.0965
940.8	49.59	0.6713	0.1419
997.6	50.21	0.5211	
1040.7	49.44	0.4087	
1105.3	50.84	0.2400	
1157.7	51.27	0.1739	
1209.0	52.32	0.0976	
1066.7	14.40	1.5761	
1089.2	16.41	1.1490	
1102.3	15.23	0.9609	
1150.4	15.99	0.7678	
1183.7	14.77	0.4837	
1184.1	16.13	0.4788	
1197.7	15.24	0.4236	
1241.9	15.44	0.2384	
1265.1	14.26	0.1543	
1316.4	15.57	0.0914	
Mixture M5: 2.037% DME, 11.894% O_2, 46.124% N_2, 39.945% CO_2 (ϕ=0.514)			
T (K)	P (bar)	τ (ms)	τ_{1st} (ms)
1003.9	34.52	1.0576	
1011.4	35.25	1.0482	
1070.0	36.64	0.6792	
1103.9	36.47	0.6811	
1212.0	35.51	0.2524	
1248.5	35.15	0.1466	
1300.2	34.57	0.0873	
Mixture M6: 7.359% DME, 10.788% O_2, 41.837% N_2, 40.016% CO_2 (ϕ=2.046)			
T (K)	P (bar)	τ (ms)	τ_{1st} (ms)
713.7	33.83	1.6668	
745.6	34.20	0.8809	0.5823
818.1	35.55	0.5596	0.1435
867.8	35.87	0.5228	0.0875
892.0	33.98	0.6777	0.1524
952.3	35.28	0.6349	
1001.3	35.03	0.5382	
1038.2	34.02	0.4296	
1097.1	33.39	0.3012	
1098.1	36.11	0.2601	
1147.8	35.73	0.2002	
1217.9	35.60	0.1011	



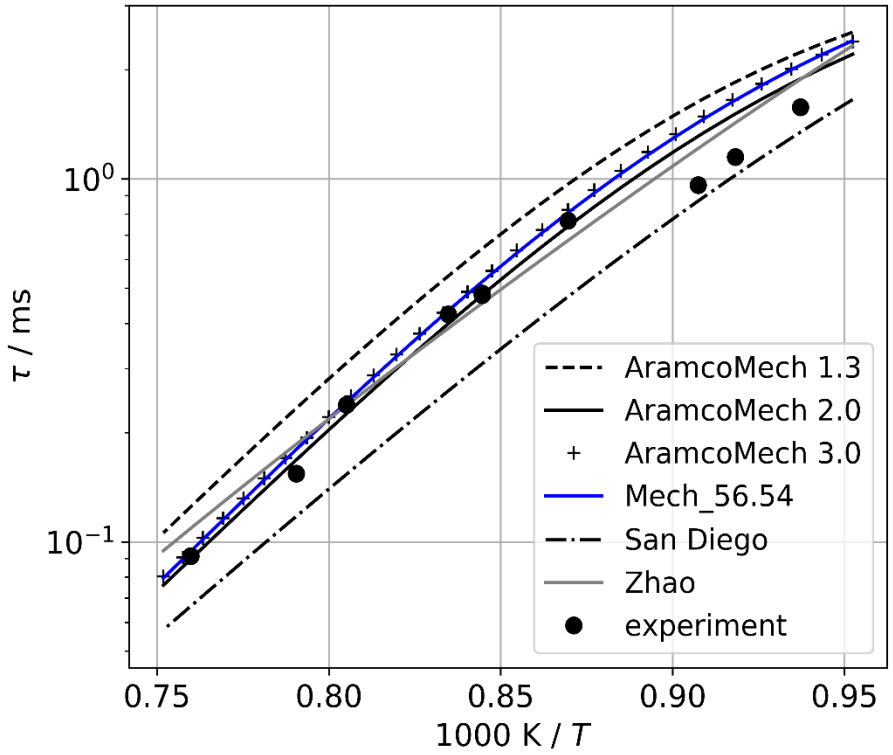
Comparison of ignition delay times obtained based on the time history of OH radical and temperature time history for Zhao and San Diego mechanism. Ignition delay times correspond to the mixture M4 at a pressure of 35 bar



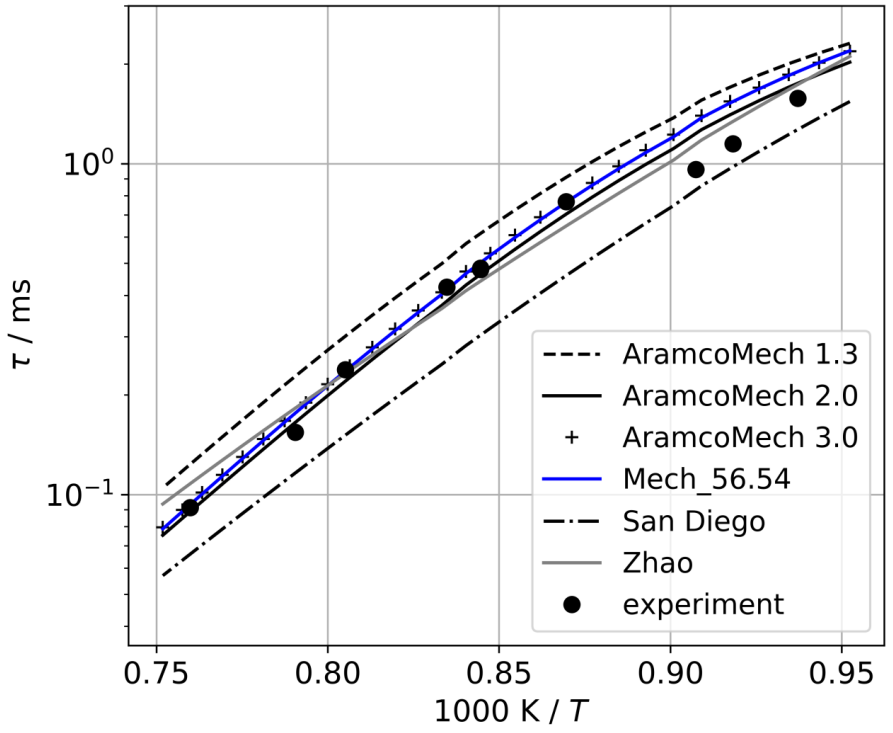
Performance of various reaction mechanisms at nominal pressure of 35 bar for stochiometric mixture M4 (φ = 1.0) obtained with constant volume assumption



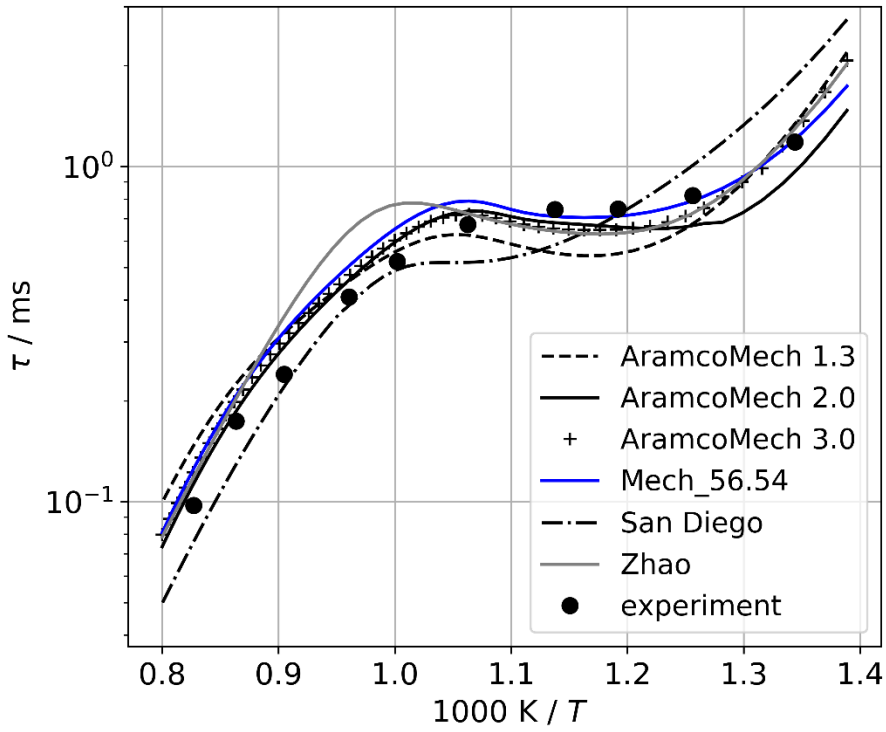
Performance of various reaction mechanisms at nominal pressure of 35 bar for stochiometric mixture M4 (φ = 1.0) obtained with variable volume assumption



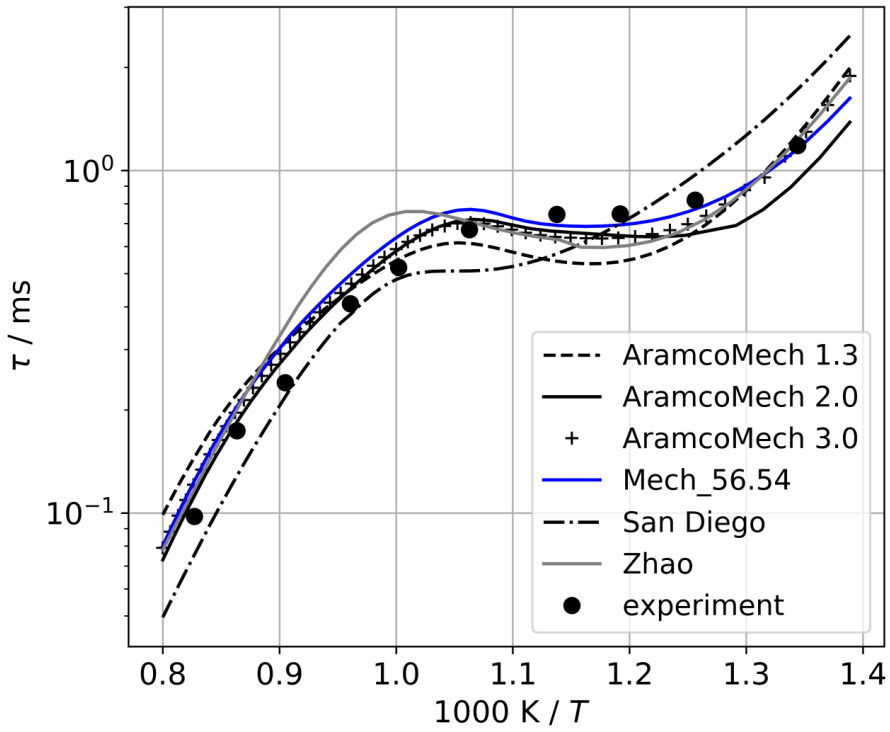
Performance of various reaction mechanisms at nominal pressure of 15 bar for stochiometric mixture M4 (ϕ = 1.0) obtained with constant volume assumption



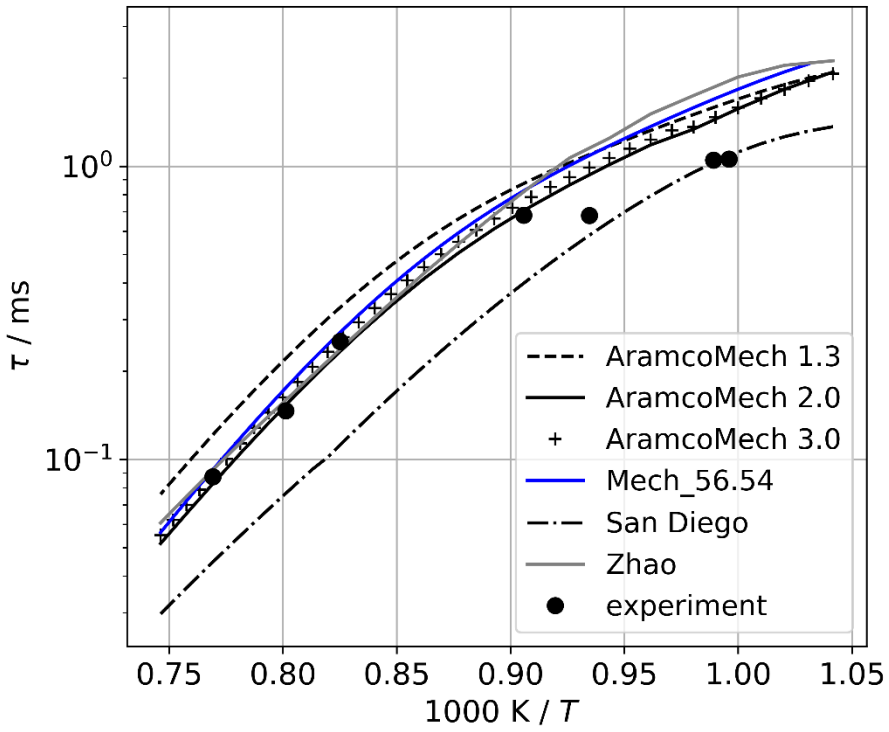
Performance of various reaction mechanisms at nominal pressure of 15 bar for stochiometric mixture M4 (ϕ = 1.0) obtained with variable volume assumption



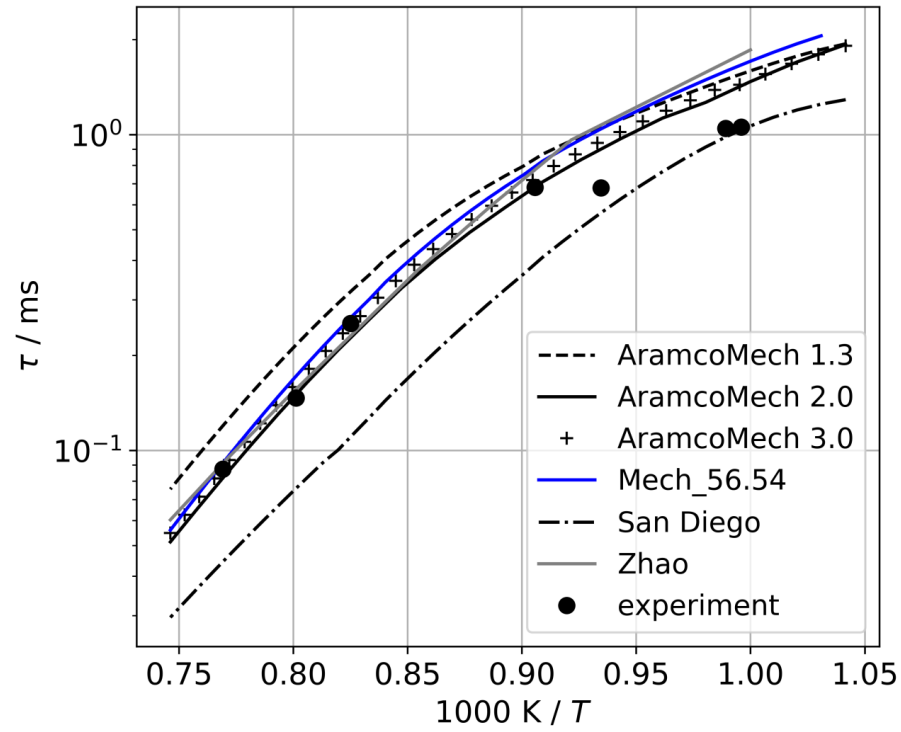
Performance of various reaction mechanisms at nominal pressure of 50 bar for stochiometric mixture M4 (ϕ = 1.0) obtained with constant volume assumption



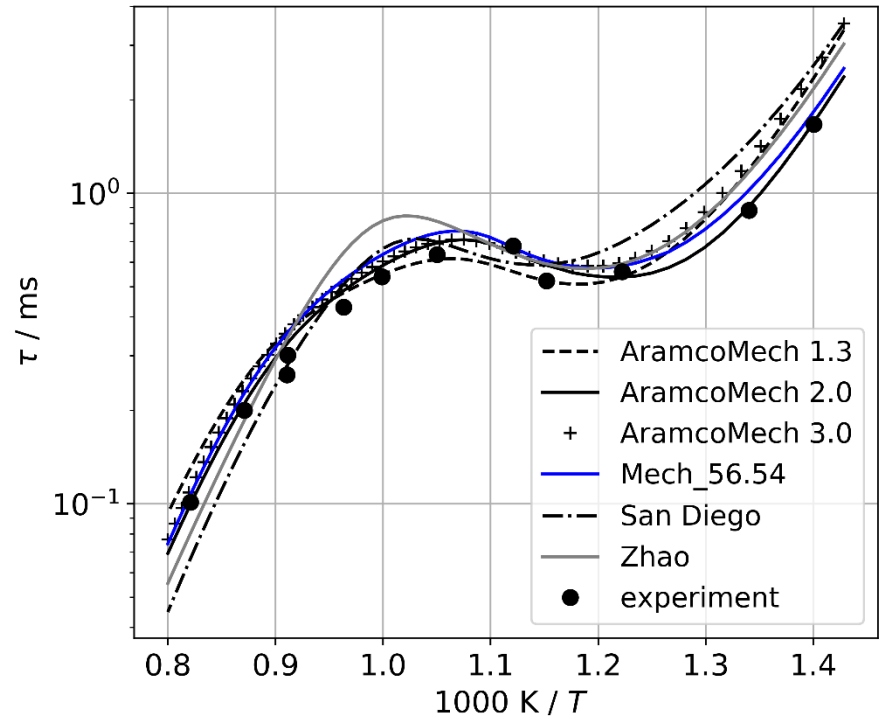
Performance of various reaction mechanisms at nominal pressure of 50 bar for stochiometric mixture M4 (ϕ = 1.0) obtained with variable volume assumption



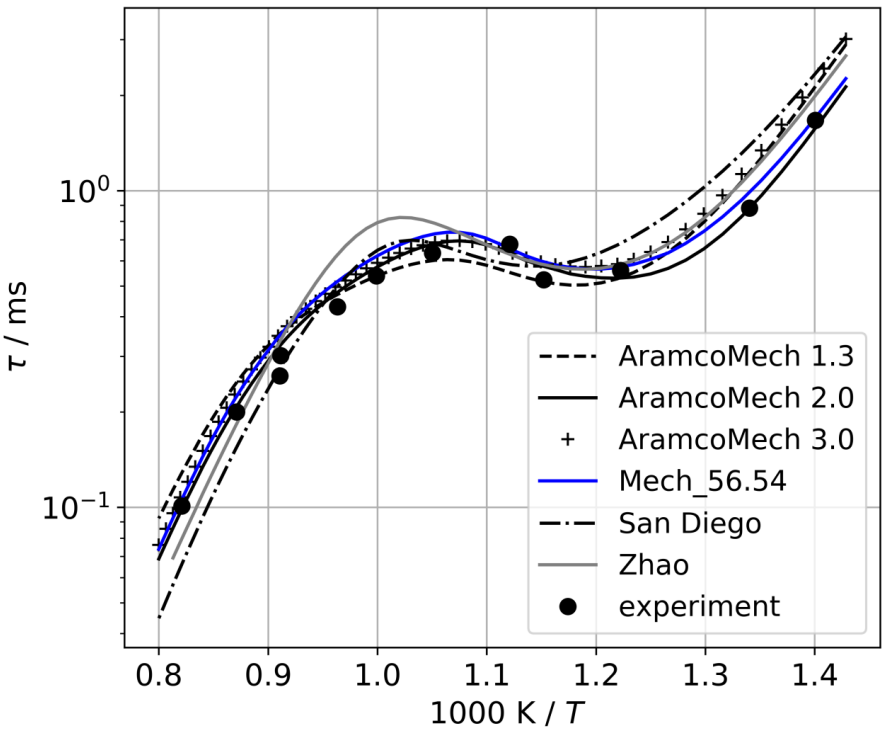
Performance of various reaction mechanisms at nominal pressure of 35 bar for lean mixture M5 (ϕ = 0.5) obtained with constant volume assumption



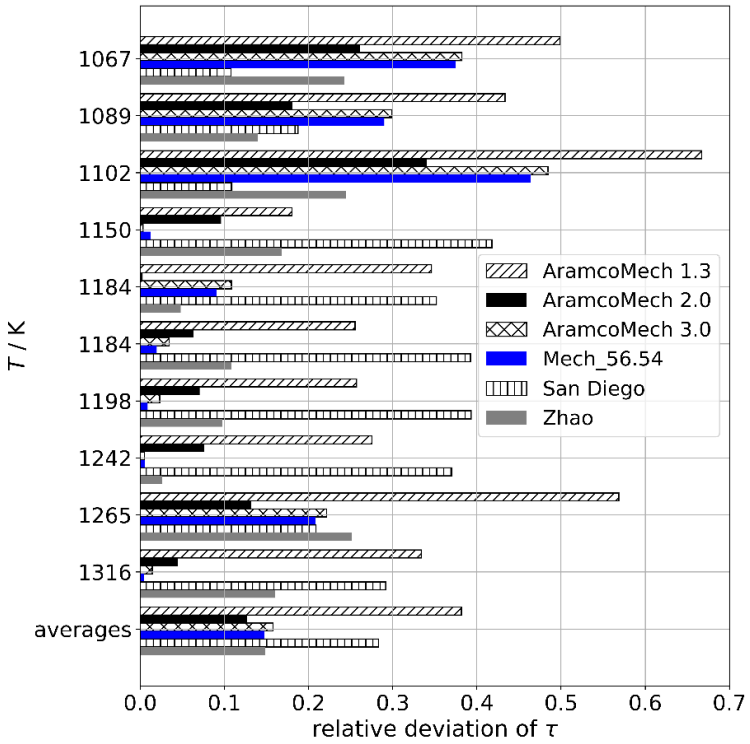
Performance of various reaction mechanisms at nominal pressure of 35 bar for lean mixture M5 (ϕ = 0.5) obtained with variable volume assumption



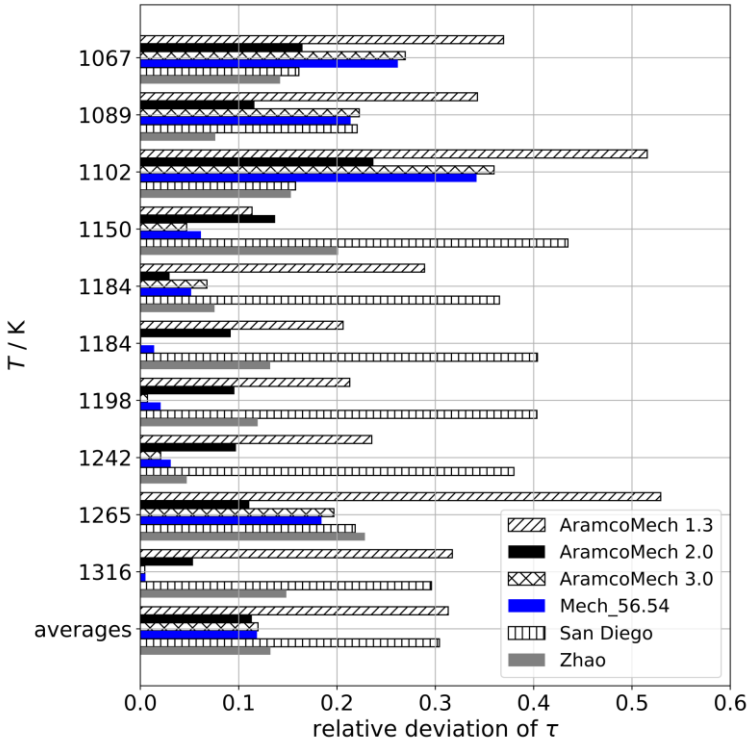
Performance of various reaction mechanisms at nominal pressure of 35 bar for rich mixture M6 (ϕ = 2.0) obtained with constant volume assumption



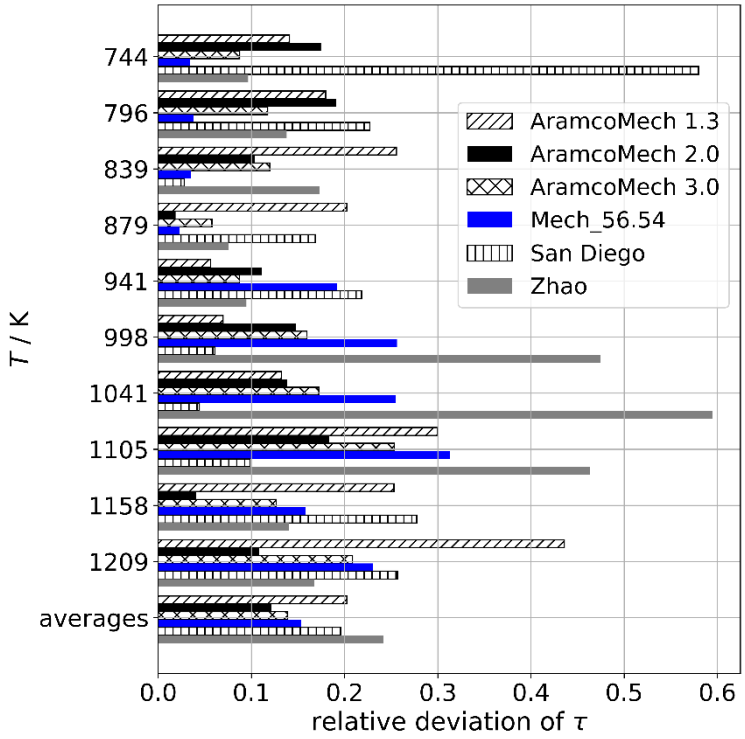
Performance of various reaction mechanisms at nominal pressure of 35 bar for rich mixture M6 (ϕ = 2.0) obtained with variable volume assumption



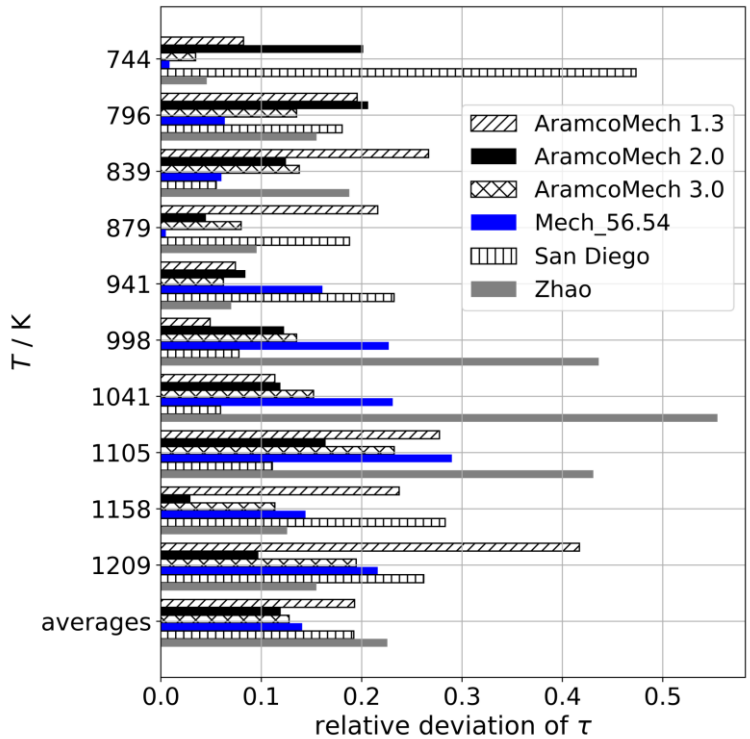
Evaluation of different reaction mechanisms: Relative deviation between predicted and measured ignition delay times of stoichiometric DME/air mixture diluted with 40% CO_2 (mixture M4) using exact measurement conditions corresponding to nominal pressure of 15 bar. Ignition delay times were predicted using the constant volume assumption.



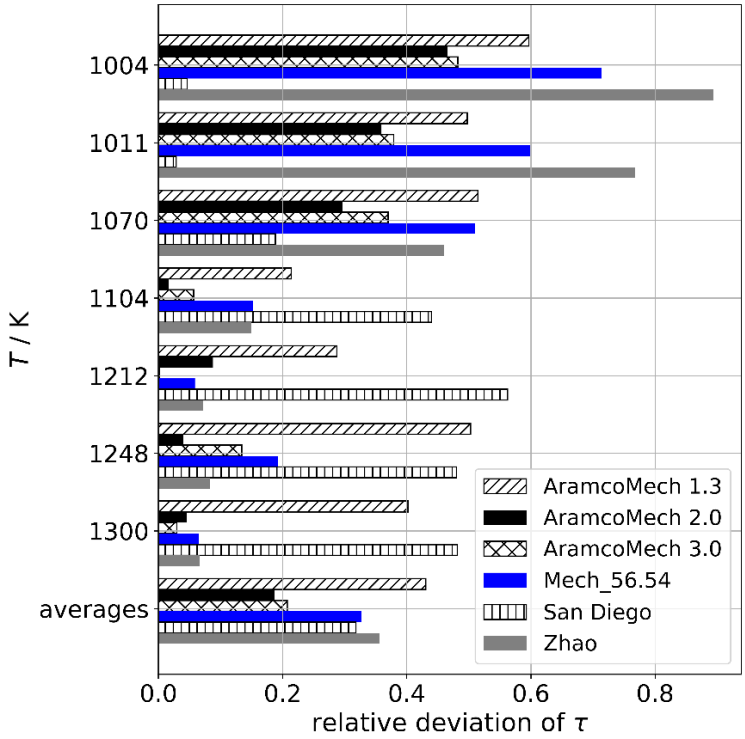
Evaluation of different reaction mechanisms: Relative deviation between predicted and measured ignition delay times of stoichiometric DME/air mixture diluted with 40% CO_2 (mixture M4) using exact measurement conditions corresponding to nominal pressure of 15 bar. Ignition delay times were predicted using the variable volume assumption.



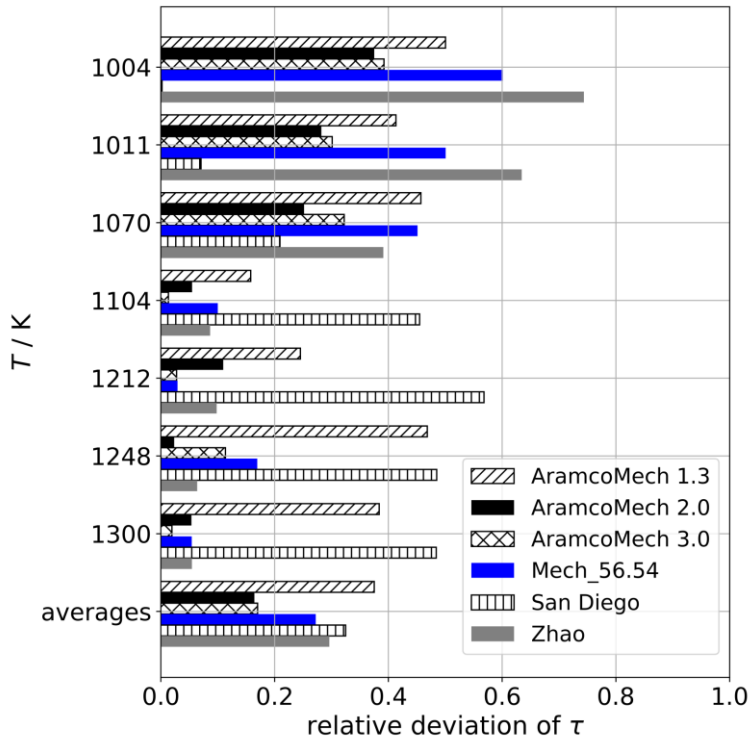
Evaluation of different reaction mechanisms: Relative deviation between predicted and measured ignition delay times of stoichiometric DME/air mixture diluted with 40% CO_2 (mixture M4) using exact measurement conditions corresponding to nominal pressure of 50 bar. Ignition delay times were predicted using the constant volume assumption.



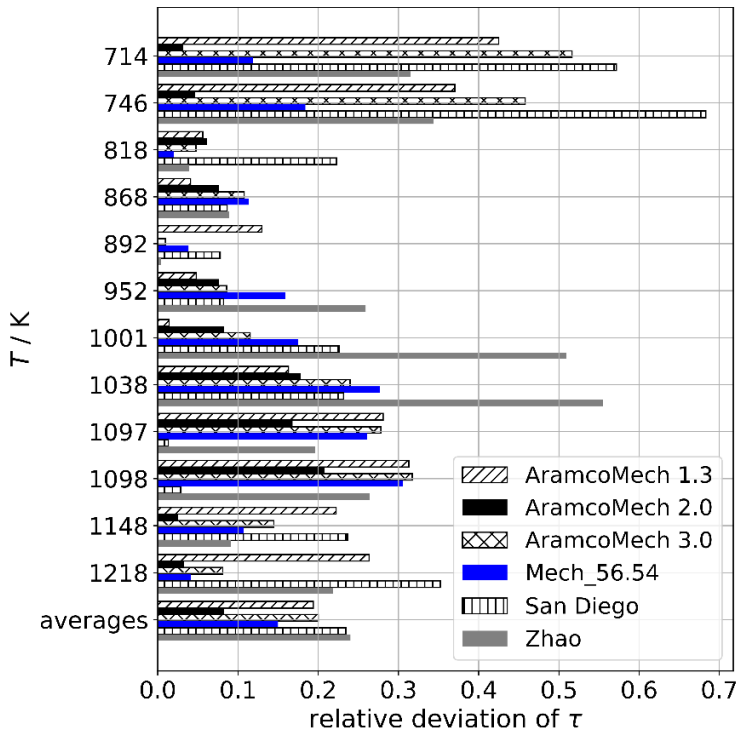
Evaluation of different reaction mechanisms: Relative deviation between predicted and measured ignition delay times of stoichiometric DME/air mixture diluted with 40% CO_2 (mixture M4) using exact measurement conditions corresponding to nominal pressure of 50 bar. Ignition delay times were predicted using the variable volume assumption.



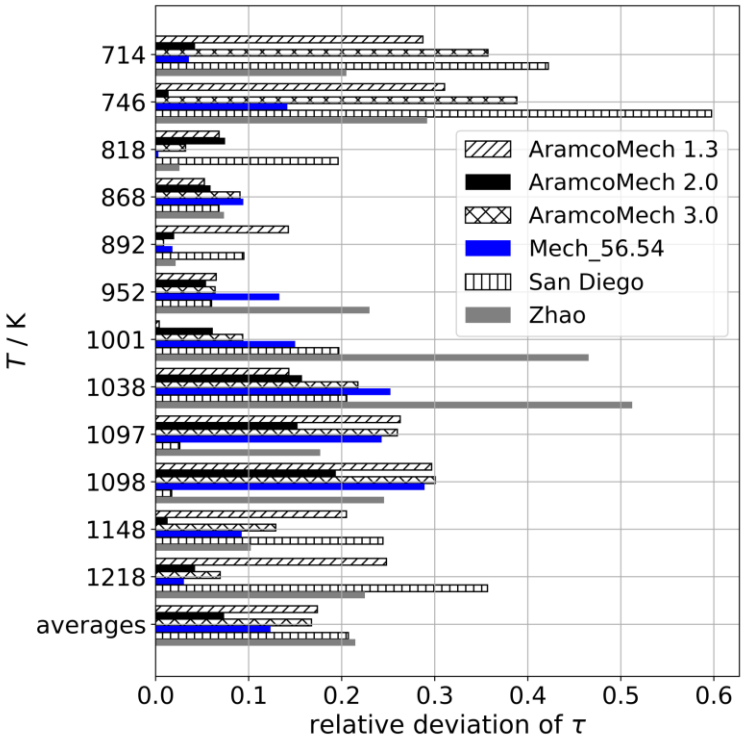
Evaluation of different reaction mechanisms: Relative deviation between predicted and measured ignition delay times of lean (ϕ = 0.5) DME/air mixture diluted with 40% CO_2 (mixture M5) using exact measurement conditions corresponding to nominal pressure of 35 bar. Ignition delay times were predicted using the constant volume assumption.



Evaluation of different reaction mechanisms: Relative deviation between predicted and measured ignition delay times of lean (ϕ = 0.5) DME/air mixture diluted with 40% CO_2 (mixture M5) using exact measurement conditions corresponding to nominal pressure of 35 bar. Ignition delay times were predicted using the variable volume assumption.

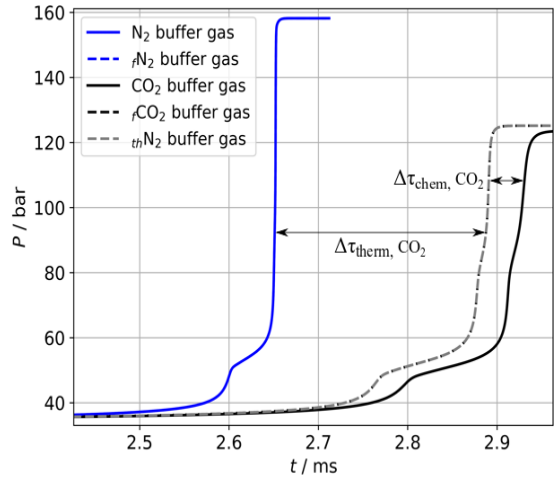


Evaluation of different reaction mechanisms: Relative deviation between predicted and measured ignition delay times of rich (ϕ = 2.0) DME/air mixture diluted with 40% CO_2 (mixture M6) using exact measurement conditions corresponding to nominal pressure of 35 bar. Ignition delay times were predicted using the constant volume assumption.

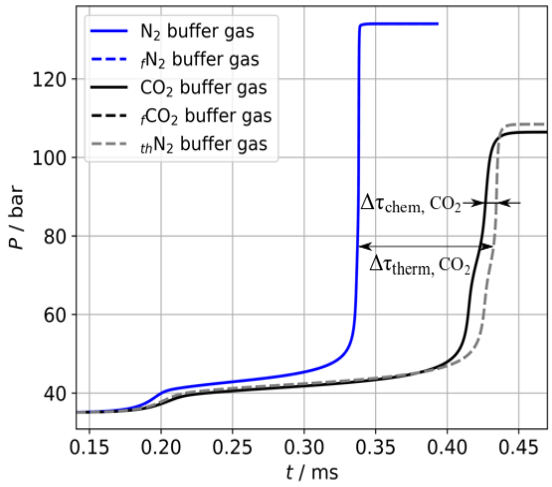


Evaluation of different reaction mechanisms: Relative deviation between predicted and measured ignition delay times of rich (ϕ = 2.0) DME/air mixture diluted with 40% CO_2 (mixture M6) using exact measurement conditions corresponding to nominal pressure of 35 bar. Ignition delay times were predicted using the variable volume assumption.

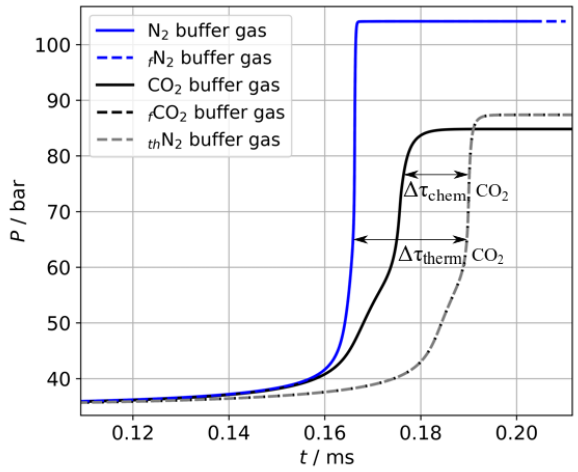
a)



b)



c)



Thermal and chemical effects of CO_2 on ignition delay time using Zhao mechanism according to approach in Fig. 7 for pressure of 35 bar and temperature of 700 K (a), 850 K (b) and 1150 K (c)

Ignition delay times obtained with different real (N_2, CO_2) and fictive ($_fN_2$, $_fCO_2$, $_{th}N_2$) buffer gases using AramcoMech 2.0 and Zhao mechanism

		Ignition delay time (ms) for different buffer gases				
Mechanism	**Temperature (K)**	**N_2**	**CO_2**	**$_fN_2$**	**$_fCO_2$**	**$_{th}N_2$**
AramcoMech 2.0	700	1.9403	2.0692	1.9427	2.0408	2.0358
	850	0.2323	0.3580	0.2447	0.3449	0.3241
	1150	0.1370	0.1521	0.1448	0.1656	0.1564
Zhao	700	2.6515	2.9112	2.6515	2.8829	2.8829
	850	0.3377	0.4173	0.3377	0.4311	0.4311
	1150	0.1660	0.1729	0.1660	0.1891	0.1891